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Aligning university–industry interactions:
the role of boundary spanning in intellectual capital transfer

Technological Forecasting and Social Change

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Aligning university–industry interactions:
the role of boundary spanning in intellectual capital transfer

Abstract:

In the UK, the boundary spanning role has taken on greater significance as successive governments emphasize how universities should play in direct knowledge transfer and changing academics' visions over third mission functions. Studies in the UK have focused on the relative performance of technology transfer organizations (TTOs) / knowledge transfer organizations (KTOs) or their use by academics and external organizations. Compared to their US and international counterparts, TTOs/KTOs at UK universities exhibit low-levels of absolute efficiency. Therefore questions remain relating to how to raise the efficiency and productivity of these units, how to attract and train staff with suitable qualifications/capabilities and how to change adverse attitudes towards knowledge exchange by some academics. Currently, there is a lack of a holistic view of these functions and the way they complement each other or coordinate their activities. This study addresses this gap in theory and practice and advances how universities should provide consistency in both the internal and the external interfaces, by the offer of a framework and key stakeholder insights.

Keywords: university – industry interactions, boundary units in universities, knowledge transfer offices, organizational alignment, instrumental case study.

1 Introduction

This paper offers a holistic framework for the role of technology/knowledge transfer in UK universities operating as a ‘boundary unit’. Currently, this interface between academics and external organizations is blurred, but it is indisputable that the performance of these units has a role to play in the overall performance of the university and the external society in which it serves. Such units are well understood in most developed countries, such as the US, where it is clear how and why they contribute to the academic institution. However, while this role has become increasingly more important for universities internationally that share similar ambitions to maximize performance efficiencies, this is particularly more so in the UK where traditional income streams through teaching and governmental research council funding have been squeezed. This begs the general question of how such a role can be best nurtured for enhancing their effectiveness and better defining within UK universities to give them greater prominence.

Knowledge transfer in universities has been the subject of considerable recent interest: from support systems (Hewill-Dundas, 2012) to specific channels for transfer efficiency (Bekkers and Bodas Freitas, 2008), but the common denominator has rested on the role of the transfer unit itself and their critical success factors (eg. Berbegal-Mirabent, Sabate and Canabate, 2012). Hence, this paper draws on the development of the transfer unit, to which we assign the literary field of ‘boundary units’. We identify a lack of ownership and direction for claiming identity to such units, and which require more holistic governance; hence, we draw on theories of organizational alignment to assimilate this area to understand better how consistency can be provided in both internal and external interfaces, and present empirical evidence on this in practice. This relationship between university, industry and government is known in the established literature as the ‘triple helix’, and its effectiveness in

knowledge transfer has been favoured, say over a ‘double helix’ (eg. Ivanova and Leydesdorff, 2014) or in general (eg. Fernandez-Esquinas et al, 2015; Nielsen and Cappelen, 2014). The helix actors are known for their inability to be aligned by common interest, thereby making knowledge transfer more complex and constrained (see Huggins, Johnston and Stride, 2012; Serbanica, Constantin and Dragan, 2015; and Rosi and Rosli, 2015). Hence, we use prominent thinking in organizational ‘alignment’ to assist the present research. We present findings about the value of university-industry (UI) interactions, and offer suggestions for improving this relationship, and hence overall performance, through internal organizational effectiveness.

2 Knowledge Transfer Organizations in the UK

The effectiveness of knowledge transfer has been broadly researched (eg. Agrawal, 2001), and their equivalent functions have been compared internationally (eg. Arvanitis, Kubli and Woerter, 2008; Chin and Lim, 2012). Equally, a lot of attention has been paid by the UK government in supporting technology/knowledge transfer offices in UK universities and changing academics’ visions over third mission functions, particularly in the 1980s (Howells et al., 1998) when the right to exploit research results through intellectual property (IP) was transferred from the British Technology Group to academic institutions. Since then, many universities have developed strategies for protecting and using innovations deriving from academic research. Many higher education institutions (HEIs) began setting up specialised IP management and administrative centres, commonly known as technology licensing offices, within or parallel to existing Industrial Liaison Offices. However, many universities found effective management of their IP a problem, especially for smaller units that could not afford dedicated staff. In 2003, the Lambert Review (Lambert, 2003) noted that most universities

ran their own technology operations, but only a few had a strong research base capable of building high-quality offices. The Review recommended that Government use third stream funding to encourage the development of shared services in technology transfer on a regional basis, and also made proposals for improving the recruitment and training of technology transfer staff. This resulted in the third stream initiative by UK Government – the Higher Education Innovation Funding (HEIF) which allocated significant funding to activities concerned with dedicated knowledge exchange staff, the promotion of knowledge exchange units, institutes and research centre, and projects connected with knowledge exchange generally. Due to the significant amount of funding in the lead up to 2001, KTOs have emerged in almost all of the HEIs in the UK, under a multitude of different names including Business Development Offices, Enterprise Offices and Corporate Partnership Offices.

Several studies in the UK have focused on the relative performance of KTOs or their use by academics and external organizations. Chapple et al. (2005) highlight those transfer offices at UK universities exhibit low-levels of absolute efficiency, of approximately 26–29%. Siegel et al. (2008) compare the relative efficiency of US and UK transfer offices and find that US universities were more efficient than UK universities and that the production process was characterized by either decreasing or constant returns to scale. Additionally, despite the substantial investments, KTOs are the least frequent mechanism for interactions between academics and external organizations. Only 13% of academics have used KTOs to initiate a contact with an external partner. Abreu et al's (2009) survey of 22,170 UK academics similarly found that, in the past three years, 36% had no contact and 21% were unaware that these types of services were available. There was significant variation by discipline (with the highest level of contact being by engineers (67%) and the lowest level by the arts and humanities (36%)), position, age, research activity or type of institution. Simply

put, older and more senior academics are likely to know about, and use, their transfer office. Further, academics from Russell Group institutions are much less likely to have their interactions initiated by the university transfer office, whereas initiation by it was highest in the younger universities. The relative minor importance of transfer offices is probably because many of the interactions are informal and people-based and do not always require contractual and transactional inputs. Thus, where a transfer office is likely to have a greater role is where interactions require a significant legal or contractual component.

Similarly, only 37% of external organizations surveyed were aware of HEIs' transfer offices, while only 8% of them claimed that interactions with universities were initiated by the KTOs (PACEC/CBR 2009). The number of firms citing 'unrealistic expectations of transfer offices' as being a very important barrier to interaction with universities increased from 24% in 2004 to 49% in 2008, which is a striking shift in a short space of time (Bruneel et al, 2009). A survey of top 122 universities in the UK (Lockett and Wright, 2005), as ranked by their research income, highlighted the lack of internal skills in this area and suggests that universities and policy makers needed to devote attention to the training and recruitment of transfer officers, with broad base commercial skills. Looking for explanations, Bruneel et al (2009) argue that only after 2008 did UK universities begin to build highly professional systems for technology transfer, and it is likely that a period of adjustments will be required before the consequences of these changes can be fully assessed.

Various solutions are presented from the studies. Chapple et al., (2005) suggest that improvements in performance may require the creation of smaller specialized transfer offices at universities, rather than just increasing their size per se. Consecutively, the development of regionally-based sector focused transfer offices is also advised, together with an upgrade in the business skills and capabilities of UK technology transfer managers and licensing officers. Kitson et al. (2009) argue that individuals or groups playing boundary spanning

roles in universities need to understand fully and have experience of the academic and business environment, as well as skills to overcome barriers and foster relations. Therefore serious questions remain unanswered relating to how to raise the efficiency and productivity of these units, how to attract and train KE staff with suitable qualifications/capabilities or how to change adverse attitudes towards knowledge exchange by some academics.

Specific institutional arrangements have varied greatly in the UK and, over the past decade, most KTOs have restructured their organization and, in general, have moved from being part of the research infrastructure to a relative independent entity, and then to a broader focus on innovation related activities (Sharifi and Liu, 2010). This led to the view of Howells et al. (1998) that universities have taken a much more centralised and formalised approach to industry relations over the last two decades. Although ILOs were the first developments within HEIs, they have been supplemented by other specialists within research contract offices or exploitation units.

Following the significant funding received through Governmental programs, especially after 2001, KTOs have seen major changes in terms of scale, scope, strategic focus and profile. The shift from ‘technology transfer’ to ‘knowledge transfer’ has expanded the number of boundary functions for UI cooperation. Apart from those ‘classical’ boundary structures that are extensively studied in the literature – TTOs, ILOs, science parks and incubators etc. – there are a number of different organizational units that could play a pivotal role in linking universities and industry. For example, Howells et al. (1998) highlighted the role of continuing education and lifelong learning offices. The Lambert Review (2003) pointed out the roles of vice-chancellors, university career services, dedicated enquiry services for SMEs or alumni networks in facilitating better cooperation between universities and businesses. Lock (2009) suggested expanding the role of the Business Development

function, possibly in response to government incentives to promote more employer engagement. Yet, until the release of the PACEC/ CBR (2011) studies that describe the knowledge infrastructure in the UK, these boundary structures for UI links were only disparately mentioned.

Currently, despite the increased attention paid to the KTOs (eg. Schofield, 2013), there still remains a lack of a holistic view of these functions and the way they best complement each other or coordinate their activities. While there is some recent research looking at multiple actors within the university-industry relationship (eg. Ankarah et al, 2013), it has mainly been in the form of understanding key drivers of the holistic relationship, rather than how decisions operate across boundaries. Our study addresses this gap in theory and practice and advances an integrated approach, as universities should provide consistency in both the internal and the external interfaces.

3 Boundary Roles in Innovation and Knowledge Transfer

Currently, despite the increased attention paid to the KTOs, there is a lack of a holistic view of these functions and the way they complement each other or coordinate their activities. Schofield (2013) recently recognized the importance to look at the knowledge transfer collaboration between university and industry from a holistic perspective, drawing on critical success factors in the extant literature. Her proposed model highlighted the value in external contextual factors, as well as such resource-based assets as process and the individual. While she finds value in the use of the framework as a general guide for knowledge transfer decision-making, particularly in emerging economies, she advises further research “on knowledge characteristics and its translational abilities, organizational dynamics and

processes, market-related risks and impact of national cultural differences” (ibid, p. 52). For organizational dynamics and processes to be better understood, it is necessary to examine how knowledge transfer is constrained by boundaries internally, and between helix actors.

Boundaries between functions, however, have long been studied within organizational studies in the form of the ‘boundary role’. For example, Tushman and Katz (1980) directly introduced the term ‘boundary agent’ to describe those individuals who are executing a two-step process: the collection of external information and the processing and encoding of information for local use. However, much of the literature only investigates one component of this two-part process (Tushman and Scanlan, 1981a). For example, Allen and Cohen (1969) focus on those individuals who provide the other members of the organization with information, the so-called internal communication stars. Although it is assumed that these individuals are strongly connected to external sources of information it is not necessarily the case. Similarly, external communication stars may not always export information internally (Von Hippel, 1976). Boundary-spanners (or gatekeepers, as sometimes known), on the other hand, perform a number of functions for organizations, including exchanging information with the environment, reducing uncertainty, information processing, representing the organization and translating specialized knowledge between insiders and outsiders (Aldrich and Herker, 1977, Booz and Lewis, 1997, Tushman, 1977). More recently, it was found that roles of obtaining political support in organizations and scanning for ideas are the boundary activities that have the greatest performance effect (Brion et al, 2012). Therefore, boundary spanners are a valuable source of new information and ideas, have technical experience and expertise, substantial external contacts and emerge to bridge specific unit boundaries (Tushman and Scanlan, 1981b). Hence, they play important roles in innovation and technology transfer, particularly for the more mature industries where knowledge transfer is

expected (Bodas Freitas, Marques and Silva, 2013). In the innovation process, boundary spanning individuals play the role of promoting information flows across boundaries of different innovating groups and knowledge domains. While these boundaries are specifically relevant to R&D settings, the importance of transferring information across analogous organizational boundaries exists for all innovating systems (Tushman, 1977). Howells (2006) found that their activities were typically related to helping to provide information about potential collaborators, brokering a transaction between two or more parties, acting as a mediator, or go-between, bodies or organizations that are already collaborating, and helping find advice, funding and support for the innovation outcomes of such collaborations. While boundary spanning is most effective for the transfer of discreet knowledge, more is necessary for understanding the transfer of collective and complex knowledge (Zhao and Anand, 2013), which is normally that generated in universities and which requires greater collaboration. To that extent, academics may become more entrepreneurial (De Silva, 2015) and more team learning that spans across boundaries is required (Bui et al, 2015).

In turn, research centres conduct highly mission-oriented and interdisciplinary research, which is highly relevant to industry. Bozeman and Boardman (2003) present a taxonomy of university research centres and find that most of them have in common: (a) horizontal relations, which cut across different units of the university, (b) external relations with industry, government and other universities, (c) extra-research activity, including educational roles, industry interactions, scientific and professional brokering and (d) problem-driven, research focus. Further, studies in the US suggest that while affiliation with an industry related centre correlates positively with the likelihood of an academic researcher having had any research-related interaction with private companies, affiliation with centres

sponsored by governmental programmes correlates positively with the level of industry involvement (Boardman, 2009).

At the European level, and especially in the UK, Knowledge Transfer Offices (KTOs) are now the preferred approach for university–industry interactions. Although many variations may be encountered, a KTO should typically be staffed by professional knowledge transfer experts, develop and execute the research institution’s strategy in respect of working with industry and users of research results, help identify, evaluate and (where appropriate) protect intellectual property, advise on commercial issues, promote the use of inventions and other R&D results, disseminate information, collect and distribute the revenues (European Commission, 2007). The European Knowledge Transfer Association’s (PROTON) Annual Survey for the fiscal year 2009 indicates that European KTOs are on average 14 years old, as compared to 18.5 years in the US. The average staffing level in 2009 for European KTOs was 7.8 full time equivalent staff (FTEs) and the average annual budget was about € 422 K (Piccaluga et al., 2011).

KTOs are the preferred approach in the UK and, in contrast to the US model, many university KTOs have taken on broader missions and recognize the wide spectrum of channels for exploiting university knowledge, including skills and competence (Sharifi and Liu, 2010). However, despite massive investments by the UK government, numerous constraints still exist in raising the profile of KTOs and there is much room for debate on how to identify, train and educate gatekeepers in boundary units in order to enhance their roles in technology and knowledge transfer (Gilman and Serbanica, 2012). Moreover, it is the UK’s most productive (and often larger) institutions that are most effective at commercialising and transferring their knowledge (Huggins and Johnston, 2009). While this paper draws its empirical evidence from the UK context, the study of knowledge transfer has indicated its

equal prominence across countries (eg. Chung, 2014; Ye, Yu and Leydesdorff, 2013) and does not seem to be heavily influenced by culture (Malik, 2013).

Holism, on the other hand, is discussed in the contemporary literature within strategic performance management and organizational effectiveness (eg. Chau and Witcher, 2005), and as a dynamic capability responsible for sustaining competitive advantage (eg. Witcher, Chau and Harding, 2008). These ideas could significantly assist the disjointed functions of how KTO institutions assist universities. A starting point, and perhaps most salient, is the birth literature of bringing together important perspectives of a collective entity to work together towards a common vision and strategy (Kaplan and Norton, 1996) through the use of a generic ‘balanced scorecard’ approach (Kaplan and Norton, 1992).

While the series of work by Kaplan and Norton, that have famously spanned almost three decades since the early identification of the value of intangible assets (Johnson and Kaplan, 1987) to performance management, is known to be of practitioner value and developed through consultancy than based on rigorous academic and scientific research, their premise roots back to famous Japanese organizational effectiveness that has been the subject of considerable academic investigation for some 50 years – hoshin kanri – and presented in scholarly literature (eg. Witcher and Butterworth, 2001). Acknowledged (in a footnote) by the authors themselves (see Kaplan and Norton, 1993), the balanced scorecard technique replicates the key drivers of hoshin kanri to achieve organizational alignment. It does so in the form of balanced scorecard perspectives operating synonymously against QCDE (quality, cost, delivery and education) variables, within the language of total quality management, that form the basis for hoshin kanri (Witcher and Chau, 2007) and which improves overall organizational, strategic and performance management (Witcher and Chau, 2012). Total quality management methodologies have been used historically to ensure the ‘totality’ of a

system (hence, offering the best chance to achieve holism) can be achieved at a level of quality equal to zero-deficiency; this ultimate state would allow for best alignment.

The value of hoshin kanri in western organizations has been the subject of major research funding of the UK Economic and Social Research Council (Witcher and Butterworth, 1999a), and its findings for the commercial context have been published in premium scholarly outlets (eg. Witcher and Butterworth, 1999b; Witcher and Butterworth, 2001). Its applicability to higher education for achieving alignment across the organization, particularly in conjunction with the balanced scorecard, has also been argued highly beneficial and synergistic (Asan and Tanyas, 2007). For simplicity (as the balanced scorecard and hoshin kanri techniques overlap significantly) and for the purpose of offering guidance only, we need only utilize the more commonly known work of Kaplan and Norton.

The more recent work of Kaplan and Norton argues that five principles are required to align an organization's performance management system to strategy: mobilize change through executive leadership; translate strategy into operational terms; align the organization to the strategy; motivate to make strategy everyone's job; and govern to make strategy and continual process. We draw on the third principle of the need to align the system to strategy as the cross-boundary solution to bringing together separate units of innovation and knowledge transfer. In the words of Kaplan and Norton (2006, p. viii):

“Most enterprises consist of multiple business and support units. Corporations operate diverse units under a single corporate umbrella to capture economies of scale and scope. But to achieve these benefits, the corporate headquarters needs a tool to articulate a theory for how to operate the multiple units within the corporate structure to create value beyond what the individual units could achieve on their own, without central guidance and intervention ... It also could impose implicit costs through

delayed decision making and onerous reporting requirements on operating and support units. The value creating that offsets the headquarter costs must arise from aligning decentralized units to create a new source of value, which we call enterprise-derived value.”

Beyond internal alignment, Kaplan and Norton argue the possibility of aligning external organizations: the scorecard describes objectives for various stakeholders, including the community, and defines expectations, and identifies the skills and information. By building a set of agreed scorecard objectives together, trust is also built across organizational boundaries, thereby reducing lowered transaction costs and reducing misalignment between the parties. The idea is similar to that used in hoshin kanri for consensus building, known as nemawashi in Japan or catchball in the European context (Witcher and Butterworth, 1999b). The scorecard then forms part of the explicit agreement/contract between the parties. The alignment sequence proposed by Kaplan and Norton is used later in this paper for the context of university-industry interactions.

4 Research Method

Considering the complex landscape described above, our study aimed to map traditional ‘players’ in UI interactions and to advance a conceptual framework that links them all and offers grounds for organizational alignment. Utilising ‘alignment’ brings many different concepts into play: coordination, integration, fit, synergy, fusion, congruence, etc. Within this study, we used Kaplan and Norton’s (2006) conceptualization of organizational alignment. In their view, the process starts when the corporate headquarters articulate an ‘enterprise value proposition’ that will create synergies among operating units, support units

and external partners. The alignment strategy derived from the enterprise value proposition is then complemented by an alignment process, which should consider first aligning boards and shareholders and then enterprise headquarters with operating units, support units and external partners. Using the alignment sequence as a point of reference, an organization can measure and manage the degree of alignment, and hence the synergy being achieved across the enterprise.

Table 1. Who's who in University – Industry Interactions?

KAPLAN AND NORTON'S TYPICAL UNITS IN A MULTIBUSINESS ORGANIZATION	TYPICAL UNITS IN UNIVERSITY – INDUSTRY INTERACTIONS	TRADITIONAL 'PLAYERS' IN UNIVERSITY – INDUSTRY INTERACTIONS
Board (Shareholders)	FUNDING UNITS	HEIF, RESEARCH COUNCILS, TECHNOLOGY STRATEGY BOARD, etc.
Corporate office	DECISION UNITS IN UNIVERSITIES	<ul style="list-style-type: none"> ■ Top management at institutional level (ex. the Pro-Vice Chancellor/ Vice-presidents/ Vice-Provosts with responsibilities for Enterprise/ Research/ Research and Enterprise/ Commercial services, etc.) ■ Directors of Enterprise services (Ex. Directors of Enterprise/ Research and Enterprise Office (professional services) or Directors of owned - companies in charge with providing enterprise services (Ex. Directors of Technology Transfer Companies, Consultancies etc.) ■ Decision units at the Faculty/ School level (Deans/ Head of Schools/ Head of Research in Schools/ Associate Deans for enterprise etc.) and/ or Directors of Enterprise at Faculty/ School levels

Business units	KNOWLEDGE PRODUCERS IN UNIVERSITIES	ACADEMIC STAFF In Departments/ Schools/ Institutes etc. STUDENTS
Corporate support units	BOUNDARY UNITS IN UNIVERSITIES	<p>UNITS AND STAFF OFFERING ACCES TO:</p> <p>TECHNOLOGY: Technology Transfer Companies, Commercial Services, Contract/ Legal Offices etc.</p> <p>COLLABORATIVE AND CONTRACT RESEARCH, PROBLEM-SOLVING: Applied Research Centres, Consultancy units, Research Alliances representatives, KTPs Centres, etc.</p> <p>SPACE: Universities' Science Parks, Incubation Units etc.</p> <p>FACILITIES: Conference Offices, Administrators, etc.</p> <p>CONTINUING PROFESSIONAL DEVELOPMENT (CDP), EXECUTIVE EDUCATION, TRAINING: CPD units (central units or faculties'/ Schools' offices), Business Schools (for executive education)</p> <p>STUDENT SKILLS: Career Offices, Employment Liaison Offices, Student/ Work Placement units (central units or faculties'/ Schools offices) etc.</p> <p>BUSINESS DEVELOPMENT (central units and faculties'/ Schools' offices): Business Development Teams, Corporate relations teams, Industrial Liaison Offices etc.</p>
Customers	KNOWLEDGE USERS	SMEs, corporations, business and professional associations etc.
-	INNOVATION INTERMEDIAIRES	External suppliers, consultants, business support agencies, regional administrators, regional networks, etc.

In the universities' context, we mapped the various units and 'players' with responsibilities in UI interactions and associated them to Kaplan and Norton's typical units in a multi-business organization (See Table 1). Moreover, we added one specific category that refers to innovation intermediaries, such as external consultants, knowledge service suppliers, regional administrators, etc. The following must be noted at this stage of research. First, this list is by no means exhaustive as our main purpose was not to identify all players, but to align traditional players to the proposed categories, to be able to advance a framework with 'wide' (but not particular) usability. Second, the novelty of our mapping exercise is the inclusion of multiple levels of decision units. Traditionally, the Pro Vice-Chancellors in charge with Enterprise agenda is considered to be the key artisan of alignment at University level. Our 'map' considers other levels of decision making such as Faculty/School levels and those that are in charge with managing enterprise professional services. Third, regarding the Boundary units, approximately 30% of the HEIs in England, especially top and high research clusters, follow the centralised model, and 70% the devoted model, with a centralised small central unit providing generic services to engagement by all subjects and a devoted team of KE staff within different Schools, faculties or research institutes (PACEC/CBR, 2009). Our mapping exercise accommodated both.

With the map of traditional players, we developed a conceptual framework that describes both the value proposition for UI interactions and the alignment process and tested it within a small-scale exploratory study. Unlike other holistic studies of the knowledge transfer process in higher education that may be premised on well-established variables in the extant literature (eg. Schofield, 2013), where measurable success factors are already known and readily testable, our study relied on extracting semi-inductive phenomenon to conceptualize, as well as to capture and understand as rich contextual constraints. Hence, we

present the study as an ‘instrumental’ case study (Creswell, 2007), and place the focus not on the case itself, but the case as a vehicle to understand better the alignment value proposition and process. In doing so, we developed a semi-structured interview guide and conducted eight in-depth interviews with individuals in key-positions for UI interactions at a pre-92 university. We thus turned to our interviewees’ ‘expert’ voice and mapped issues that matter, that happen or should happen to benefit from alignment synergies. Interviewees were asked to refer to their business engagement experience and not to diagnose their current activities. Interviews were 1.5 – 2 hours long and were structured around five main areas that referred to key-players in UI interactions, roles and responsibilities, enterprise value-proposition, internal and external alignment processes.

The framework was developed using established case technique (see Eisenhardt, 1989), and by adhering to the guidelines on naturalist inquiry and constant comparison techniques (Lincoln and Guba, 1985; Strauss and Corbin, 1990). In essence, the framework was created through three distinct stages of analysis. First, the open ended interviews offered the opportunity to create a primary coding structure (first-order) that related to the university-industry context, and the generic issues of Kaplan and Norton’s alignment methodology offered general categories from which to form basic codes to group themes that emerged about knowledge transfer. These general codes were seen as ‘parent codes’, with which subsequent related but secondary order to those issues would enable a set of ‘child codes’ to be established. From these, it became clear how activities operated within the university, and how to picture them on the conceptual framework. Theoretical saturation (Glaser, 2004), meaning that no further obvious and useful information could be further sought from additional interviews or digging deeper into the respondent commentary for further codes; this was the natural position to conclude the creation of additional parts on the framework. Second, the kinds of relationships within the conceptual framework were identified from how

second-order themes related to first-order issues, thereby forming either ‘key player’, ‘reporting line’ or ‘alignment facilitators’, as shown in the key of figure 1. This meant, comparing the commentary against each key part of the framework to decide if it made sense to present the ‘actors’ in a particular way, as well as checking to ensure there was sufficient consensus across the commentary to support it. Third, the overall theoretical dimensions were aggregated to understand the full context of the framework to validate what it represented holistically. Hence, the whole of the framework was checked against the general commentaries for the final time to ensure there was consistency against each other, and also the framework would work well as a skeleton to be fleshed out with even richer commentary within the Kaplan and Norton alignment categories (for example, the challenges identified by key actors). We expect this framework, developed in this way, is both methodologically rigorous and to be useful to all those that play a role in UI interactions, and especially to those in decision units, as the framework can help both to articulate priorities and manage the degree of alignment across the organization.

5 Findings: how boundary units align university-industry interactions

In this section, we present empirical findings from the research and a conceptual framework for how boundary units help align university-industry interactions.

5.1 The UI Value Proposition

In Kaplan and Norton’s (2006) framework, the value proposition refers to a set of specific cross-organizational objectives that will create financial, customer, internal process, and learning and growth synergies among operating units, support units and external partners.

The value proposition is then transposed into strategies, action plans, quantifiable objectives, maps and balanced scorecards. In a similar way, the value proposition for UI interactions should describe those actions to be taken in order to obtain financial, customer, internal process, and learning and growth synergies. Given the majority of knowledge transfer offices' activities in the UK are externally funded, mainly through the HEIF and that funding comes after an assessment of institutional strategies by HEFCE, we assumed that HEIF performance-criteria are the key-guides in articulating the value proposition for UI interactions. Therefore, we translated the HEIF 'questions' into a 'must-have' approach and advanced a conceptual framework that offers grounds for alignment (Figure 1).

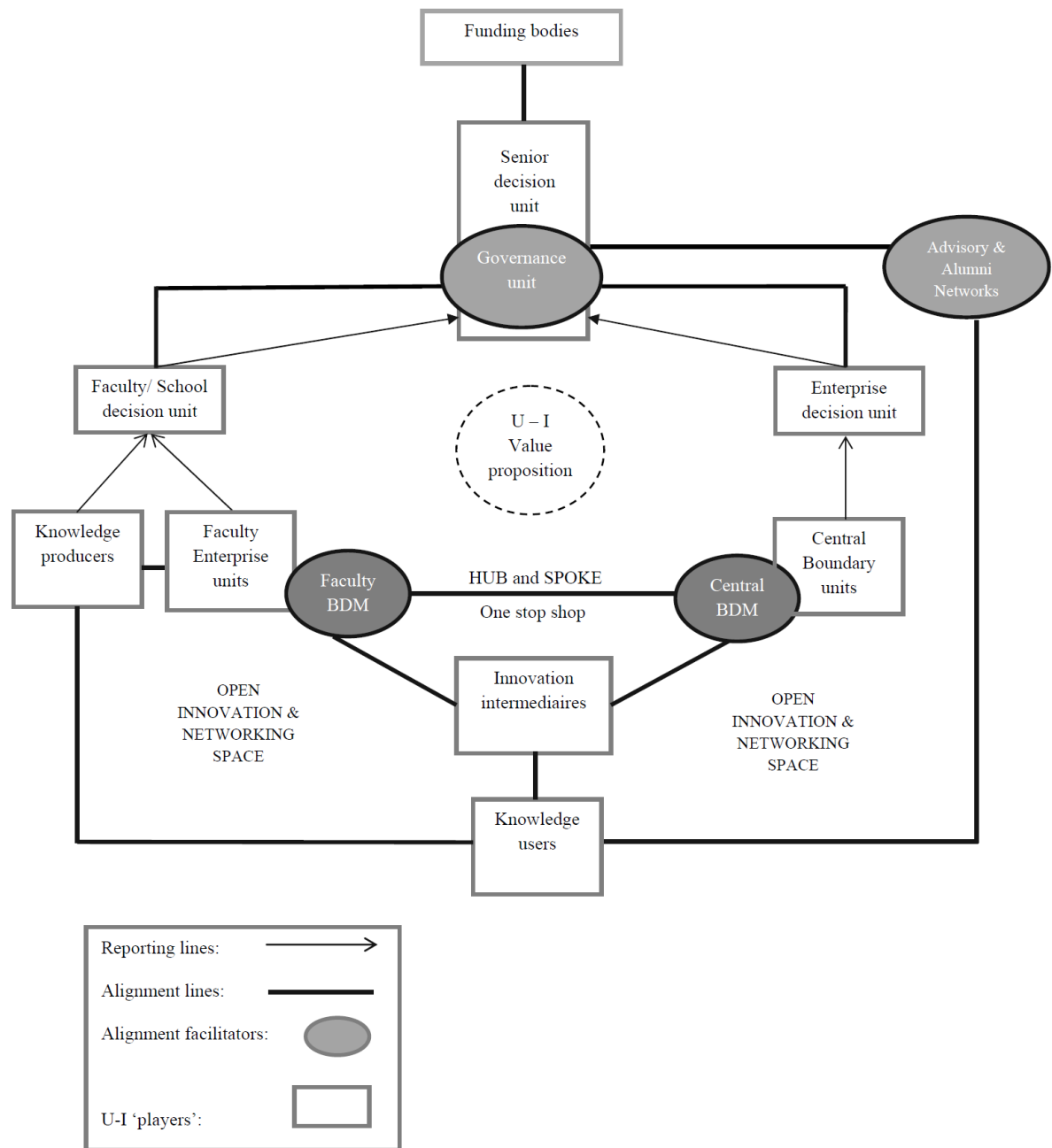


Figure 1. A conceptual framework for the alignment of university – industry interactions through boundary units

Under the financial perspective, the ‘formula funding’ enforces all universities to define adequate Key Performance Indicators (KPIs) for capturing the benefits of knowledge

exchange. In this respect, the Higher Education – Business and Community Indicators (HE-BCI) for contract research, consultancy, equipment and facilities, regeneration and IP income, together with indicators for non-credit-bearing courses and KTP income inform about developments and performances. At institutional level, financial synergies could therefore be obtained when players in UI interactions know and act towards meeting common KPIs. Within the customer perspective, universities are asked to generate economic and social impacts from their knowledge exchange activities. To meet these goals, client relationship management systems, together with a higher degree of customization and involvement of end-users in the creation of value-added could be important enablers for customer-facing interactions. Customer synergies could be therefore generated when players in UI interactions follow the ‘bespoke’ services concept. Under the internal process perspective, universities are asked to develop appropriate and robust systems for performance management and data collection, planning, risk management and monitoring and evaluation. Under HEIF5, capacity-building component based on FTE academic staff numbers is no longer considered in formula allocation; the focus is now on incentivising performance, efficiency and effectiveness in internal processes. At this point, clarity and acceptance of roles definitions becomes crucial, as well as transparency in resource allocation and monitoring systems. Internal process synergies would thus arise when all internal systems for planning, monitoring and evaluating progress against targets are functional and accessible to all players in UI interactions. Finally, under the learning and growth perspective, creating a culture that supports engagement with businesses, enterprise and entrepreneurship becomes a must. Universities are expected to consider incentive schemes that may range from royalty income from patents, equity in stake in spin-outs, remuneration for consultancy services, to funds for buying out academic time or incentive structures including promotions and assessment criteria. Hence, developing enterprise skills and

capabilities should be considered. At this point, the ‘institutional fit’ becomes crucial and the value proposition will yield nothing if the strategy for UI interactions does not fit with the institutional mission and will not be linked to teaching and research strategies. Learning and growth synergies would then arise when people are motivated to work for and share a culture that stimulates entrepreneurial actions and business engagement.

5.2 The Alignment Process

Once the value-proposition has been defined, it must be complemented with an alignment process. However, as highlighted above, even if HEIs have introduced strategies for interactions with business partners and communities and begin to integrate related aims and objectives into their overall corporate plans, only 15% had developed the strategic plan as a result of an inclusive process across the whole HEI and gained acceptance across most units (PACEC/ CBR 2009). These findings highlight that the alignment process is usually neglected, even though it is supposed to bring great synergies to UI interactions.

Kaplan and Norton (2006) argue different ways to achieve alignment, and one of which is to start at the top and then cascade downwards, while another way is to start in the middle, at the business unit level. Irrespective of the method chosen, we emphasise the process should start where the leadership and enthusiasm exist.

4.2.1 Internal Alignment

Our framework supposes that internal alignment should consider both reporting lines that lead to decision units, and alignment lines, leading to alignment facilitators (Figure 1). At least three types of internal decision units with responsibilities for UI interactions can be

identified: senior decision units at institutional level, enterprise decision units (professional services) and Faculty/School decision units. The leadership of the HEIs is critical amongst the factors that can create a coordinated approach to UI interactions. As PACEC/ CBR (2009) report highlights, many of the UK HEIs have introduced new roles at senior decision level dedicated to knowledge exchange. These new roles are carried out, for example, by Pro-Vice Chancellors for Enterprise, whose remit is to develop and implement the strategy and to engage overall responsibility for performance in UI interactions. They may also encourage and motivate, put-up a 'public face' and provide leadership, coordination and communication across all aspects of the enterprise agenda. At Faculty/ School decision level, responsibilities for the UI agenda are usually carried out by their Directors for Research, Directors for Research and Enterprise, Associate Deans for Enterprise or, in some cases, by Heads of Faculty/School and other senior staff. These decision units lead the development and implementation of the strategy at Faculty/School level and have key-roles in the engagement of academic staff. Finally, enterprise services could be under the supervision of a professional service administrator, such as a Director for Enterprise, Director of Research and Enterprise Services etc. or under the authority of an external company director, if the enterprise services are delivered by an external entity to the HEI. Their responsibilities are related to delivering the strategy, directing the support staff and managing the overall operations at this level.

On the point of boundary units, their organizational structure differs fundamentally across HEIs in the UK, and as suggested by PACEC/CBR (2009), at one end of the spectrum is the highly fragmented or modular structure characterised by a relatively large number of knowledge exchange units, each providing relatively specialised support functions, while at the other, there are HEIs providing support functions through a relatively small number of knowledge exchange units each responsible for providing a portfolio of different support

functions, that means a much more compact structure. In aligning these units, it becomes clear that a compact structure could be easily manageable and a clear tendency towards compaction could be observed in this respect. In our framework, Business Development Units (BDU) are presented as main alignment facilitators because of their capacity to internalize the ‘one-stop-shop’ concept and to align service offers. The business development infrastructure could combine central specialist support with School-based BDUs (hub and spoke models) and ‘generalist’ with industry or theme dedicated BDUs. The creation of ‘central gateways’ or dedicated ‘portals’ complements the BDUs, providing a ‘unique’ access point, especially for SMEs.

In addition to the introduction of senior level and Faculty/School level positions, many HEIs have now established governance structures such as Business and Community Committees or equivalent (Boards for Enterprise, Review groups, Steering Committees for Business and Industry etc.) (PACEC/CBR, 2011), that can take responsibilities for planning, coordinating the necessary infrastructure, monitoring and review of the wide spectrum of UI interactions, advising the leadership, etc. When properly managed, these structures can act as key enablers of alignment, due to fact that they gather all decision levels, usually under the chair of the Pro-vice Chancellor for Enterprise. To prove their effectiveness, these structures should work closely to advisory groups and alumni networks and involve a wide range of stakeholders in decision-making (e.g. senior academics with expertise, Directors of Research, Teaching and Learning, knowledge users and senior members of key-corporate partners and sponsors of research etc.).

5.2.2 External Alignment

For UI interactions, the external alignment process starts when funding bodies agree with institutional strategies and plans for UI interactions: “HEIs would only receive an allocation

where they can demonstrate a critical mass of beneficiaries and impact, as measured by external knowledge exchange earnings performance” (HEFCE, 2011b). Besides HEIF, there are some other very important funding opportunities that should be explored such as knowledge transfer schemes supported by research councils, Technology Strategy Board’s programs and delivery mechanisms to drive innovation or initiatives to support the collaboration between universities and industry at the regional level, i.e., Science city programs.

Once the funding details have been settled, the external alignment can ‘move to’ the networking and open innovation space, where all traditional players in UI interactions could meet and connect to each other. In this respect, the ‘networked’ university aligns knowledge producers and knowledge users by providing support for ‘public space’ functions: forming and accessing networks; stimulating social interaction; influencing the direction of research processes; hosting forums, meetings and conferences; establishing entrepreneurship centres; and promoting alumni networks and personnel exchanges, as well as joint industry-academia visiting committees and collaboration on curriculum development (Cosh et al., 2006). There are numerous organizations, associations and networks that are facilitating or providing support for UI cooperation in the UK, such as the Council for Industry and Higher Education (CIHE), Universities UK (UUK), the Association for University Research and Industry Links (AURIL), the Institute for Knowledge Transfer, the UK Science Parks Association, the UK Business Incubation, the Intellectual Property Office or PRAXIS – UNICO etc., whose services should be screened and accessed. Creating networks requires people to work at the boundaries, acting as translators and intermediaries for ideas and connections. Communication and knowledge-sharing are vital to collaborative efforts and are to be integrated and translated to bridge the knowledge–policy ‘gap’ (Owens et al. 2006).

Furthermore, the open innovation space is the one where supply meets demand. Universities are asked to generate economic and social impacts from their knowledge exchange activities: “we expect that collaborations will be an integral part of every HEI’s strategy ... [and] include collaborations with businesses in large-scale strategic partnerships; collaborations with business support agencies; collaborations with other HEIs to expand markets and/or gain economies of scale” (HEFCE, 2008). Nevertheless, as UI interactions are highly influenced by the absorptive capacity (i.e., a firm’s ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Cohen & Levinthal, 1990; Hotho et al, 2011), innovation intermediaries have a key-role in stimulating demand for universities’ services, mainly at the regional level. There is an underlying assumption that the knowledge generated by universities can best utilised by networking it regionally or locally among firms and other spatially proximate actors (Lawton Smith, 2007). For that reason, some universities are now trying to explore the benefits of physical alignment, by bringing together academics, boundary units and business partners in their dedicated innovation spaces, while others engage themselves in multi-partner UI alliance models, with dedicated Corporate Relations Offices. The alignment process is cyclical, consistent with the recommendations of Kaplan and Norton (2006), allowing organizations to measure and manage the degree of alignment, and hence the synergy being achieved.

6. Discussion: challenges of the alignment framework

To refine the conceptual framework and obtain expert insights from practice, a small-scale exploratory study based on in-depth semi-structured interviews with individuals in key-positions for business engagement at a the University was conducted; these were from: senior

decision unit (SDU), enterprise decision unit (EDU), Faculty decision unit (FDU), central boundary unit (CBU), Faculty boundary unit (FBU) and knowledge producers (KP) in applied research centres. These helped refine the initial alignment framework and reviewed new enablers, as well as helped our understanding of the main challenges coming from the value-proposition and from the alignment process in practice. These are now discussed.

6.1 Challenges from the UI Value-Proposition

In relation to the financial proposition, the performance indicators requested by the funding units are the most important success measures: “we measure our impacts through the income generated and we also review regularly the benefits to the UK economy in terms of skills, spending income etc.” (EDU). Yet, the key challenges are related to a lack of common metrics or KPIs across universities to measure performance, and also to difficulties in capturing business engagement non-income impacts. For example, it was noted:

“If commercial income is easily identifiable, knowledge impact on businesses and economy are very difficult to measure. And the question is: how to assess those academics who *do not charge for their services?*” (FDU).

Developing new metrics for the evaluation of knowledge transfer activities is now on UK Government’s agenda, so consistent with a view, “a move beyond linear measurements, together with a focus on capturing the richness or relationships is now expected” (KP).

From a customer perspective, focusing on key areas with competitive advantages (SDU), grouping them around major themes (EDU) and getting a customer-first accreditation (FDU) are the preferred strategies for individuals in decision units, as explained:

“We try to group our main competitive advantages around some major themes and create a huge map describing our services. We try to focus on very current issues such as tele-care, conservation, green economy, etc. We also try to pack individual expertise and create awareness for it.” (EDU)

However, some major risks could arise at this level. For example:

“First, there is the risk of looking for new businesses and loosing current customers or prioritizing strategic alliances and minimizing small, but active businesses; second, there is a risk of developing proposals that are not realistic for delivery. You *don't have to say 'Yes' if you can't do it or pass it to an assistant*” (FDU).

Beside these, success depends on academics' level of agreement for sharing clients and contacts centrally: “in most cases, academics prefer their personal routes” (FDU). Not taking advantage of a growth in enterprise activity and business knowledge exchange becomes, then, very challenging: “when knowledge is embodied in individual plans and projects, *you can't expect synergies in business engagement*” (KP).

The internal process is simply its existence, as argued by one interviewee: “you should first ensure there is a process to apply research and expertise and then communicate the strategy within the organization ... *[so]* data collection, planning, monitoring and evaluation systems should all be functional” (FDU). From knowledge producers' point of view, reliable information systems should make both businesses and academics aware of opportunities, such as: “*we all should be on the circulation list to find out at a click what's on the enterprise agenda*” (KP). Moreover, a clear strategy, coupled with a realistic operational plan that considers all resources (human, financial, logistic, informational, relational) and

procedures for a rationale allocation are seen as key-enablers to internal process. For example:

“It’s very simple to make things happen: first, you keep only the things you are good at and abandon the ones that make you lose your time; then, you create a business-like strategy and make it meaningful to employees, so that they can translate it into their daily jobs” (CBU).

Yet few, if any, of these were well developed or integrated.

The main challenges related to learning and growth factors are related to difficulties in engaging academics about the activity. One interviewee commented on the priorities of work, before that of enterprise, as there are obvious trade-offs:

“We should first focus on teaching students. That’s where money comes from! And on reaching the REF targets. After that, we try to buy academics’ time for interactions with industry for a few pounds!” (SDU)

Further, the lack of a proper balance between research and enterprise is perceived as a major threat in keeping with the enterprise agenda:

“On the one hand, there are pressures to meet REF targets, so that academics devote most of their time to preparing scientific papers. On the other hand, if good performance in research guarantees access to funding and promotions, than business engagement incentives become insignificant. Look at us to get money into your research!” (KP)

Other challenges identified in the research relate to the alignment process, next explained in this paper.

6.2 Challenges Coming from Alignment Process

6.2.1 Internal Alignment

Challenges lie predominantly at the top institutional level with internal alignment, and as described by one interviewee: “if the strategy is not driven from the senior level, or it lies on a senior executive desk, then it becomes a ‘third leg’ strategy” (FBU). Unfortunately, “in many HEIs, the senior unit is concerned only with increasing the flow of income from private partners and leave the Enterprise Strategy to Directors of Enterprise” (EDU). It is at the senior decision level where proper incentives should be established and where the rules of open communication should be established. For example:

“It is true that a strong leader that drives changes becomes unpopular; nevertheless, change can only happen from the top level. People should not feel intimidated to ask and say their opinions. A good leader will always listen to them all, as strategy cannot be delivered in isolation” (CBU).

Leaving the strategy to individuals in enterprise units is perceived as being very risky, as “they experience serious gaps between responsibility and authority” (SDU). In this respect, the US funding model is seen as “hugely more successful: there are big transfers of money to finance proof of concept and develop novel research area, while academic and industry really work together” (SDU). Challenges can also arise when faculties/ schools’ agendas are not in line with the institutional ones (FBU), when action plans are missing or are replaced by ‘rhetorical’ directives (CBU) or when strategies do not frame an overall mission, but just some fragmented projects (KP). As one interviewee notes: “the best strategy should not have

plenty of works, but clear actions to be taken; it should not only state where we want to be, but how we can be there” (CBU). Moreover, “strategy and implementation should be seen as one and the same” (FBU). To mitigate possible risks, all individuals in UI linkages should “have a chair at the decision table” (FBU): when inclusive enterprise governance structures are in place that do more than reporting on a regular basis, but engage changes when necessary, then chances for alignment increase considerably.

Regarding different boundary units, challenges could arise when not all units are identified as enterprise units (EDU), when some of them are not taking part in decision-making (FBU) or when various offices develop missions of their own and overlap in functions (FDU). A clear role definition in boundary units is crucial to alignment and should by necessity refer to informing decision-making, analysing competition and identifying existing market trends, enabling academics to apply their research, enabling students to link with the business community, promoting good ideas, bringing in money to stimulate them and illustrating value and impact of cutting edge research and business management expertise. In this respect, the ‘one-stop-shop’ model mitigates the risks of having businesses confused, while hub and spoke arrangements prevent internal ambiguities.

6.2.2 External Alignment

Aligning the strategy that comes from the value-proposition with funding units’ criteria (especially with the HEIF) is perceived as the most important challenge by respondents in decision units. One interviewee strongly put it:

“Enterprise funding is very prescriptive. The Government says *you’ll have money if* you focus on this, so we have to comply with it. For instance, if the HEIF double weighs income from SMEs, we have to double our focus on SMEs.” (EDU)

At the SDU level, success is perceived as a question of luck, “as the funding bodies often change targets, so we have to guess what their next target will be; in addition, the bigger the university, the less probable it will generate enough income” (SDU). Discontinuity in funding can seriously affect the enterprise agenda. For example: “it takes years to develop relationships and *trust to make things happen ... [and]* with substantial cuts in funds, you can lose staff, contacts and links. Long-term support is therefore vital” (SDU). For individuals in boundary units, having enterprise positions exclusively financed through the HEIF is seen as an important internal risk, as explained:

“Universities and faculties should always devote a pot of money to UI cooperation. *We can’t only depend* on external funding, because cuts can dramatically affect strategic targets. We try continuously to train people in enterprise positions and keep in touch with advancements in knowledge transfer, but cuts make these people redundant.” (EDU)

Aligning knowledge users with the enterprise agenda is also very challenging, especially for individuals in decision units. One example might be:

“Where we are is where the companies are and much depends on their absorptive capacity and their interests. Unfortunately, SMEs usually have immediate needs, while large companies ask -why do we need you? They will probably change their attitude in the future.” (EDU)

Besides the challenges related to the absorptive capacity, the cultural differences can also impede collaborations. One strong view is that: “numerous studies have shown that the key-

problem is at the business level, even if the *Government blames universities ... [and] the cultural tradition is very sceptical, although we give businesses something on a plate at a very low price*” (SDU). Moreover, respondents in our pilot study were aware of the fact that *“the vast majority of knowledge doesn’t come from universities, but from businesses”* (FDU) and that *“if confusion persists in universities, business representatives will put order in the system and will provide private (educational) services, as it happened in the health sector”* (CBU).

To overcome the barriers coming from interactions with knowledge users, respondents adopt different solutions: promoting market-intelligent strategies (FDU), *“being where the business representatives are (regional networks, companies’ boards, Chamber of Commerce etc.), to bring credibility for the services”* (EDU), *“going out and telling people what we can do”* (CBU), initiating networks to bring academics and businesses together (FBU). Finally, making use of the advantages of innovation intermediaries is also perceived as a key to success; as one interviewee put it:

“Innovation intermediaries play a decisive role in aligning universities with industry. Businesses should be convinced that we can assist growth and development, make innovative ideas grow, offer access to new ideas and new systems and that impact could be seen on the bottom line. (FDU)

Innovation networks, action learning, briefings, innovation clubs and direct meetings are therefore the main vehicles used to animate the networking and open innovation space (EDU, FDU, FBU).

7 Conclusion

This study has focused on UK universities’ experience in knowledge transfer and considered the relatively low efficiency and productivity of TTOs/ KTOs in the UK and the very

complex institutional arrangements in UI interactions. Our purpose was to produce a holistic approach to unfold complexities and offer grounds for organizational alignment.

Consequently, the U-I alignment framework supports a strategic and inclusive process for business engagement in universities, considering the multitude of traditional ‘players’. The framework was revised and refined within an exploratory–instrumental case study.

Despite its small scale, the case study has revealed some important differences in visions between interviewees. On the one hand, those in decision units think first about HEIF, income generation and winning grants, pointing out that the enterprise strategy is, in fact, the HEIF strategy. On the other hand, individuals in boundary positions think first to knowledge users, innovation potential and absorptive capacity, considering that ‘business engagement is not about what we can do, but about what business want to do’ (EDU). Some interesting differences in boundary units can also be observed on a push-pull axis: the ‘push’ approach is specific to those whose role is to push expertise outside the university, acting as selling agents, or to those who do not fully understand their boundary role. The demand-led approach, with attention being paid to market needs and to simultaneously meeting knowledge producers and users expectations, is the one that favours strategic thinking and organizational alignment. Not least, to some extent, knowledge producers are ‘blamed’ for some difficulties in UI interactions, as “for those that have been academics all their life, it is very difficult to understand how businesses work” (CBU).

However, neither the Government, knowledge users, nor academics can be blamed for difficulties in UI interactions: and looking to identify ‘guilty’ persons does not help. As our study has revealed, there is still much room for coordination within universities and challenges exist for all traditional ‘players’. The challenges are systemized in Table 2, allowing those who use the framework to assess the level of alignment in practice, on a simple three level scale.

Table 2. The U-I alignment framework in practice

Conceptual framework		Key challenges	Practice		
U-I value proposition			1*	2*	3*
Financial	Know & act towards KPIs	“Formula” funding and HE-BCI indicators are known.		X	
		KPIs and intended outcomes have been defined.	X		
		Non-metric indicators are also in place.	X		
		Spending patterns have been established.		X	
Customer	Follow the ‘bespoke’ concept	Key-areas with competitive advantage have been clearly defined.		X	
		Main activities, targeted sectors and geographical focus have been established.		X	
		Offers are realistic, clearly „packed” and customized.	X		
		Diagnostic, needs analysis, solutions, brokerage, CRM systems are in place.	X		
Internal process	Make internal systems functional	Human, financial, logistic and informational resources are fairly allocated.	X		
		Data collection and monitoring systems are functional.	X		
		Progress against deliverables is transparently and regularly reported.	X		
		Comprehensive risk management assessment is kept under regular review.	X		
Learning & growth	Promote a business-like culture	Business engagement activities are formally recognized in the University’s reward and promotion systems.		X	
		Balanced workload modes are considered.	X		

		Incentive schemes and support for academic staff to engage in KT activities are in place.	X		
		Knowledge transfer staff are also offered development opportunities.		X	
The alignment process			1*	2*	3*
Internal	Develop leadership in decision units	Business engagement is championed at the senior level (PVC preferred) and devised at the Faculty level.	X		
		The value proposition for university – industry interactions is transposed into strategies and operational plans.	X		
		Faculties’ agendas are in line with the institutional KT strategy.	X		
		Rules of two-way open communication are clearly established.	X		
	Foster inclusiveness in governance structures	Governance structures are in place, preferably under the chair of a senior.	X		
		Governance structures involve academics, key staff from across the university at senior and middle management levels and knowledge users in strategy formation.	X		
		Enterprise units are fairly represented in governance structures.		X	
		Advisory boards and alumni networks are considered.		X	
	Assure coherence in boundary structures	All enterprise structures have been identified as boundary units.	X		
		There is clarity and acceptance of role definition in boundary units.	X		
		Hub and spoke models are in place, with a balanced central and departmental		X	
		The one-stop-shop is functional.		X	

External	Comply with funders' expectations	Funders' expectations are considered in strategy-making.		X	
		Possible changes in targets have been taken into account.	X		
		Additional funding sources (including internal allocations) have been identified.	X		
	Endorse the 'networked university' concept	Opportunities to develop/ to adhere to research networks with other HEIs and non-HEIs partners have been identified.		X	
		Support for public space functions (meetings, forums, visiting committees, personnel exchanges etc.) is granted.		X	
		There is a permanent contact with professional organizations offering support to university - industry cooperation.		X	
	Embrace the 'open innovation' paradigm	Innovation intermediaries have been screened and contacted.		X	
		Regionally-focused initiatives and opportunities have been explored.		X	
		Spatial integration of 'science park' and academic provisions has been considered.		X	

1* = No, 2* = Partial/problematic, 3* = Yes

Our study has, no doubt, its own limitations, mainly because of its generalization purposes that carry the risks of over-simplification. In addition, our small-scale study does not capture enough experiences to validate the framework. Nevertheless, the study was assumed as exploratory, not descriptive, and its instrumental levers helped us in capturing evidence from practice and in designing a framework that posits an understanding on the social dynamics of university intellectual capital. Future studies are then envisaged to

capture additional empirical evidence and to inform decision-making about various and complex challenges in university knowledge transfer and the new role of universities in the 21st century.

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